the thermograph in the early hours; but this was not serious because the temperature at that time was, for the purpose, not used, and the consequent "cusp" in the curve afforded a record of the clearness of the sunrise.

The temperatures as observed at Mandeville are quite interesting. The highest temperature recorded during four years 1912–1916 was 89.2° F. The lowest recorded temperature was 56.1° F. On four days only did the thermometer fail to reach 70° F. The warmest night, August 12, 1915, the thermometer did not fall below 74.6° F. The mean daily variation from the normal for four years is 12.4°.

When the thermometer goes above 85° it is considered hot, and when it drops below 60° it is considered cold.

Wind.—Wind observations were not made automatically as no anemometer or wind recording apparatus was carried. General observations showed, however, that the prevailing wind comes from the ESE. While hurricanes occasionally pass near the station, the most severe was the one of November, 1912, when the maximum wind velocity was estimated at 55 miles per hour. It was believed that owing to the broken and hilly nature of the country about Mandeville, this figure is probably correct.

Rainfall.—Rainfall is very heavy. The mean of 28 years is 87.84 inches. The minima of the rainfall seem to occur in February and July. It always rains hard, and most generally comes in sharp, short showers. So sharp is the edge of a shower that it has rained on one side of the house and not at all on the other. On the average it rains 182 days each year. The heaviest rainfall recorded for 24 hours was 9.90 inches. Attention is called to the fact that the rainfall minima for the island seem to have a certain relation to the sunspot period. It was concluded that there was a diminishing of rainfall about 1.3 years after every sunspot maximum and minimum, although no attempt is made to trace the relation definitely.

Dew.—Dew is quite important in astronomical work and it was found to be so heavy that a desirable means of measuring it was sought. It was measured by the following device, consisting "of a square blackened funnel measuring 60 cm. on a side and 10 cm. in depth. It is supported in a wooden box at a height of 50 cm. above the ground, and is so arranged that fresh air can reach the under side of the funnel, which is also blackened. A bottle collects the precipitated moisture. While some of this is retained on the funnel, experiment shows that this is in a large part compensated by some which is precipitated on the under side of it." The maximum dewfall recorded was one standard gallon per hundred square feet of surface.

Clearness.—The clearness of the sky and the quality of the "seeing" are, of course, of paramount importance to the astronomer. Observations were made on sunshine and starlight as well as upon the clearness of the atmosphere, and it was found that the number of clear days and nights is unusually large. Also the sky seemed much clearer than in temperate zones. "The sky appears darker, possibly owing to the complete absence of any more or less permanent auroral illumination. The most noticeable effects are in the whiteness of the Moon as distinguished from its yellow color in the north, the brilliancy of the Milky Way, the distinctness of the Zodiacal Band at midnight and of the Gegenschein, which sometimes appears as early as 9 o'clock, and the brilliancy of comets' tails." In general, it is believed that good "seeing" does not associate itself with dry air, but the very contrary, for the best "seeing" at Mandeville seemed to come on very wet nights. This tends to disprove the contention that observatories should be built in deserts. The only advantage of such a location over that in Jamaica is that there might be a greater percentage of clear nights, although that is not necessarily true.—*C. L. M.*

THE RELATION BETWEEN WIND AND THE DISTRIBUTION OF PRESSURE.[1]

By H. JEFFREYS.

[Abstract reprinted from Nature (London), July 17, 1919, p. 398.]

A classification of some 600 wind observations over the North Sea, according to their velocities and directions, showed that the most striking feature of the resulting values was their asymmetrical frequency distribution. From the fact that this was noticeable in nearly every class, it was inferred that it could be produced only by variation in turbulence or systematic contortion of the isobars, on a scale too small to be recorded on the weather map. The latter cause, however, and also such variations in turbulence as keep the coefficient of eddy viscosity the same at all heights, would lead to strong correlations between S/G and α, which are not observed. Hence it is concluded that the principal cause of variation in the relation of the surface wind to the gradient is variation in the vertical distribution of turbulence; and it is shown that such variation could give the effects actually observed.

MOTION OF THE AIR IN LOWEST LAYERS OF THE ATMOSPHERE.[2]

By G. HELLMANN.

[Abstract reprinted from Science Abstracts, July, 1919, p. 311.]

The ground wind is investigated by measurements of wind velocity at five different heights between 5 and 200 cm. above unobstructed ground near Berlin, and it is found that in this lowest layer the mean wind velocities are proportional to the fourth roots of the corresponding heights.

The previous work of the author for heights varying from 200 cm. (2 m.) to 258 m. above the ground gave rise to a similar result, in which, however, the velocities were proportional to the fifth roots of the corresponding heights.—R. C.[3]

LOCAL WIND VARIATIONS.

[Reprinted from Meteorological Office Circular, Mar. 26, 1918, pp. 2-3.]

There is a natural tendency to assume that a single anemometer gives a fair representation of the wind over a large area. A study of the records from the two anemometric stations at Southport shows that the assumption is by no means always justified. At Hesketh Park, the climatological station to which all Southport observations, except those of wind, refer, the anemometer vane is 50 feet above ground, 20 feet above the tallest trees in the park, and 30 feet above those nearest it. The records of wind strength, given by an anemobiagraph, and of direction, given by a Baxendell anemoscope, show considerable gustiness under all conditions. At the Marshside wind station, about a mile

[1] Royal Society, London, June 26, 1919.
[2] Preuss. Akad. Wiss. Berlin, Ber. 22. pp. 404-416, 1919.
[3] Cf. Prof. notes No. 6, p. 572, above.

NNE. from Hesketh Park, there is a free exposure. The vane is 62 feet above the ground, which is flat and open. There is no tree or other obstruction within ½ mile (except some very low buildings to the SE.); while from WSW. through N. to E. is absolutely open.

The records for the instruments at this station, two Dines anemometers and a Baxendell anemoscope with twin recording cylinders, show far less gustiness than those from Hesketh Park.

The differences between the directions of the wind at the two stations are sometimes very striking. They mostly occur with fairly light winds from easterly points. There was a striking example on the night of October 1 and 2, 1917. The speed of the wind at Marshside at 23h. 30m. was 3.5 m/s and the veer from N., 124°. Up to midnight, the wind freshened and reached 5.4 m/s, then it fell off again to 2.7 m/s at 0h. 35m. During the whole of this time it was veering slowly, the direction being given by 138° at midnight and 146° at 0h. 35m.

On the other hand, at Hesketh Park, during the same period, the wind was too light for measurable speed to be given by the anemobiagraph. The direction from 23h. 30m. to midnight was about 150° from N., i. e., not far different from that at Marshside, but at midnight there was a sudden shift to 70°. Agreement was not restored for half an hour.

It will be seen that the wind at Hesketh Park during this half hour had no apparent relation to the general flow of air, such as would be shown on a weather map. It may be noted that the temperature of the air at 16h. at Hesketh Park had been 294A. At 23h. 30m. it was 284 A. so that there was probably a well-marked inversion in the upper air. As the wind at Marshside strengthened, there was a fall of the Hesketh Park temperature to 283 A. at midnight, and this was followed by a corresponding rise as the wind dropped. The direction differences are, however, by no means always associated with temperature peculiarities, and often occur with somewhat higher wind speeds than in the foregoing instance, and last longer

ON THE VELOCITY OF THE WIND IN THE STRATOSPHERE.

By J. Rouch.

[Abstract of note in Comptes Rendus, Paris, 1919, vol. 168, pp. 1281-1283.]

In view of the generally accepted statement to the effect that winds of the stratosphere are light, the following note may be of interest. The mean wind velocity during 78 pilot-balloon ascensions which reached 10 km. altitude from coastal stations in France is as follows, for each kilometer from 0 to 10: 3.3, 5.1, 5.1, 5.0, 6.0, 6.4, 7.3, 7.9, 8.5, 9.5, 11.8. Thirty-six of these reached or exceeded 11 km. and 7 went above 15 km. If we may assume that the stratosphere was from 11 km. up, the winds in the stratosphere were stronger than those at 10 km. two times out of three. This is the case with clear weather and moderate winds below. What the conditions are when the sky is cloudy, or when the winds of the troposphere carry the balloon out of sight before it can reach the stratosphere, is unknown.—*C.F.B.*

THE DRIFT OF METEOR TRAILS.

[Abstracted from Nature, London, May 23, 1918, p. 232.]

Observations made upon the enduring trails of meteors have given some clue as to the speeds of the upper winds as well as the directions. The data as a whole are not of sufficiently accurate a character to enable definite conclusions to be drawn; nevertheless, there can be little doubt as to the general correctness of the results. The streaks of the Perseids and Leonids, which are usually seen at an altitude of 55 or 60 miles, have yielded an average movement eastward of 121 miles per hour. The individual speeds varied from nil to 360 miles per hour. Certain streaks gave evidence of a series of differing currents underlying each other, the upper sections drifting in different directions from the lower.

Note.—In reference to the above article in Nature, Dr. C. J. P. Cave has replied that the trails of meteors remain luminous too long to be due to heating of the air by the passage of the body. He suggests that the trail is a result of the ionization of the air by the passage of the meteor and the subsequent flow of electricity through this ionized air. He questions the reasonableness of such rapid movements in the stratosphere.—*C. L. M.*

THE PREVAILING WINDS OF THE UNITED STATES.

By Robert DeC. Ward.

[Abstracted from Annals of the Association of American Geographers, vol. 6, 1916, pp. 99-119.]

One of the chief factors to be considered in discussing economic climatology is the wind. As a vehicle for the transportation of moisture and temperature, it wipes out the climatic boundaries, determines rainfall and the distribution of life. Nor is the speed less important than the direction, for upon it depend both physical comfort and many of the practical activities of life. As a source of power the winds are coming more and more to be appreciated in their full significance.

The greater part of our country lies in the belt of the prevailing westerlies, although the southern States share also in the trade winds. These winds find their great initial cause in the differences of temperature and pressure between the Equator and the Poles; but they are modified greatly by local effects introduced by the North American continent, such as seasonal changes of temperature and pressure, mountains and lowlands, and the Great Lakes. The general configuration of the country, the trend of mountains and valleys, locations to windward or leeward of mountains or lakes, the hour of day or night, land and sea breezes, all these have a part in controlling the direction and velocity of the wind at a station. Indeed, so strongly marked are some of these local effects that it is difficult to believe that the prevailing winds are westerly.

It is desirable, however, in studying the broad climatic effects, to eliminate as far as possible these local influences With this in view, the winds of January and July are discussed. (See figs. 1 and 2.) "From midwinter to midsummer, taking place gradually, as winter merges into spring and spring later merges into summer, there is a great swing of the winds over the eastern United States, from the pervailing northerly and northwesterly to a prevailing southwesterly or southerly direction in July." The warmest winds of the summer are those along the Atlantic seaboard. Sunstroke weather, cholera infantum epidemics, and suffering in the crowded cities are the result; sea bathing, electric fans, thin clothing, and cooling beverages are also closely applied to these warm winds. They are of economic importance in their relation to the spread of the brown-tail moth north and east from Massachusetts, and of the cotton boll weevil north from Texas.